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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/723,445	11/26/2003	Prabhu Krishnamoorthy	543.011US1	5969

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EXAMINER	
BITAR, NANCY	
ART UNIT	**PAPER NUMBER**
2624	

NOTIFICATION DATE	DELIVERY MODE
06/25/2009	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

request@slwip.com

Office Action Summary	Application No.	Applicant(s)	
	10/723,445	KRISHNAMOORTHY ET AL.	
	Examiner	**Art Unit**	
	NANCY BITAR	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10 March 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-21* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-21* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *01 July 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *3/10/2009*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's response to the last Office Action, filed 12/9/2008, has been entered and made of record.

2. Applicant has amended claims 1,10-12,20,21. Claims 1-21 are currently pending.

3. Applicant's arguments, see pages 7-9 , filed 3/10/2009, with respect to the rejection(s) of claim(s) 1-21 under 35 USC 103 (a) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Francois et al (EP 1225541)

Examiner Notes

4. Examiner cites particular columns and line numbers in the references as applied to the claims below for the convenience of the applicant. Although the specified citations are representative of the teachings in the art and are applied to the specific limitations within the individual claim, other passages and figures may apply as well. It is respectfully requested that, in preparing responses, the applicant fully consider the references in entirety as potentially teaching all or part of the claimed invention, as well as the context of the passage as taught by the prior art or disclosed by the examiner

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. **Claims 1-21** are rejected under **35 U.S.C. 103(a)** as being unpatentable over Francois et al (EP 1225541) in view of Li et al (Combining Front Propagation with Shape Knowledge for Accurate Curvilinear Modeling)

7. As to claim 1, Li et al et al teaches a computer-assisted method comprising: accessing stored volumetric (3D) imaging data of a subject (at 100, an axial set of images is acquired, figure 1, paragraph [0008])

; representing at least a portion of the 3D imaging data on a two dimensional (2D) screen (Locate ROI, 102, figure 1) ;

receiving user-input specifying a single location on the 2D screen (at 103, the user selects a region of interest by depositing a seed point, figure 1 and 2)

computing an initial centerline path of the tubular structure (figure 5); obtaining segmented 3D tubular structure data by iteratively performing a segmentation that

separates the 3D tubular structure data from other data in the 3D imaging data using the single location as an initial seed for performing the segmentation (segmenting said plurality of slice images responsive to said deposited seed point and in accordance with a plurality of predetermined classification values to extract said three-dimensional sub-structure. Claim 1; paragraph [0010-0012]) .While Francois meets a number of the limitations of the claimed invention, as pointed out more fully above, Francois fails to specifically teach iteratively correcting the initial centerline path using the segmented 3D tubular structure data while the segmentation is iteratively performed .Specifically, Li et al. teaches an accurate curvilinear modeling uses *a priori* shape knowledge embedded in a deformable model. In addition, it also embodies front propagation. A modified tubular deformable model to implement the constraints is used . A propagation map is then constructed from a start point using FMM, and then backtracked when the end is reached to generate the Minimal Cost Path. At each point on the MCP, the original data is resampled in planes perpendicular to the local orientation of the MCP. A deformable tubular model is constructed inside the resampled data and allowed to deform so that it recovers the object of interest. Towards the end of the deformation, an adaptive deflation force replaces the original inflation force. Finally, the curvilinear model is obtained by extracting the spine of the tubular model and transforming it back into the coordinates of the original data. It would have been obvious to one of ordinary skill in the art to correct the centerline path in Francois in order ensures that rapid symmetric changes, such as a sharp turns, are not lessened while many asymmetric changes, such as a branching event or aneurysms, can be removed to a large extent. In addition,

deforming the model in the transformed data domain vastly simplifies the computation, making it efficient. Therefore, the claimed invention would have been obvious to one of ordinary skill in the art at the time of the invention by applicant.

As to claim 2, Li et al teaches the method of claim 1, further comprising incrementally extracting from the 3D imaging data a central axis path of the tubular structure (The centerline is located by detecting optimal responses derived from Hessian matrices at a range of scales of interest. this class of algorithms produce good results but problems may occur at junctions or tangent vessels, page 67, 3rd paragraph)

As to claims 3 and 4, Li et al teaches the method of claim 2, in which the performing the segmentation further comprises: initializing a front at an origin that is located along the central axis path; initializing a propagation speed of evolution of the front to a first value; propagating the front by iteratively updating the front, the updating including recalculating the propagation speed (We use a modified tubular deformable model to implement the constraints. A distance field is first constructed and then uniformly thresholded to obtain suitable propagation channels. A propagation map is then constructed from a start point using FMM, and then backtracked when the end is reached to generate the Minimal Cost Path, section 3, page 68);comparing the propagation speed to a predetermined threshold value that is less than the first value; if the propagation speed falls below the predetermined threshold value, then terminating the propagating of the front; and classifying all points that the front has reached as pertaining to the tubular structure (section 3.2; note that the pre-processing is performed by first thresholding the image, and then computing a distance map using a

chamfer algorithm [11]. Once the end points and are selected, a connected-component analysis is performed to determine the local peaks in their neighborhoods in the distance map. The distance map is thresholded if the values at those peaks exceed a target value; page 69)

As to claim 5, Li et al teaches the method of claim 1, further comprising: computing a central vessel axis (CVA) of the segmented 3D tubular structure; representing a 3D image of a region near the segmented 3D tubular on a two dimensional (2D) screen; displaying on the screen a first lateral view of at least one portion of the segmented 3D tubular structure, the first lateral view obtained by performing curved planar reformation on the CVA of the segmented 3D tubular structure (section 3.2-3.3);displaying on the screen a second lateral view of the at least one portion of the segmented 3D tubular structure, the second lateral view taken perpendicular to the first lateral view; displaying on the screen cross sections, perpendicular to the CVA (At each point on the MCP, the original data is resampled in planes perpendicular to the local orientation of the MCP, page 68); and wherein the 3D image, the first and second lateral views, and the cross sections are displayed in visual correspondence together on the screen (see Li et al, figure 3, the carotids are visualized using Maximum Intensity Projection (MIP), along with their ACMs).

As to claim 6, Li et al teaches the method of claim 1, further comprising masking data that is outside of the 3D tubular structure (figure 2, and section 4, page 71).

As to claim 7, Li et al teaches the method of claim 1, further comprising computing at least one estimated diameter of the segmented 3D tubular structure(figure 1, section 3.1, page 68-69)

As to claim 8, Li et al. teaches the method of claim 7, further comprising flagging at least one location of the segmented 3D tubular structure, the at least one location deemed to exhibit at least one of a stenos is or an aneurysm (page 68, figure 1; vessel with eneurysm; vessel stenosis, section 3.2 page 69).

As to claim 9, Francois teaches the method of claim 7, further comprising displaying the segmented 3D tubular structure using a color-coding to indicate the diameter (figures 5 and 6).

As to claim 10, Li et al teaches the method of claim 1, further comprising displaying the segmented 3D tubular structure in a manner that substantially similar to a display of a result of a conventional angiogram (section 3.2).

The limitation of claims 11-21 had been addressed above .

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to NANCY BITAR whose telephone number is (571)270-1041. The examiner can normally be reached on Mon-Fri (7:30a.m. to 5:00pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vikkram Bali can be reached on 571-272-7415. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Nancy Bitar/
Examiner, Art Unit 2624

/Vikkram Bali/

Supervisory Patent Examiner, Art Unit 2624